MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018 SESSION

PPC 0116 – PRE-CALCULUS

(All sections / Groups)

6 JUNE 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages with 4 questions.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1 (25 marks)

(a) (i) If $z = m + 2i$ and $w = 1 - 2i$, find $\frac{\overline{z}}{w}$ in standard form. Give your answer in its simplest form in terms of m. [5 marks]

(ii) Express $i^7 + 2i^2 + 4i$ in standard form. [2 marks]

(b) Simplify $\dfrac{\left(\dfrac{x-4}{x^2-4}\right)}{\left(\dfrac{x^2-x-12}{x^3-8}\right)}$. State the restriction on the value of x so that the expression is defined. [5 marks]

(c) Solve $x = 4\sqrt{x+2} + 3$. [4 marks]

(d) Solve the inequality below. Express your answer using set-builder notation. [5 marks]

$$3\left|\frac{4x-1}{2}\right| \leq 9$$

(e) Solve the inequality below. Express your answer using interval notation. [4 marks]

$$-1 < \frac{3-5x}{3} \leq \frac{3}{2}$$

Continued...

Question 2 (45 marks)

(a) Table 1 below shows the prices of fruits sold by a stall.

Fruit	Price (RM)
Banana	4.50
Apple	1.90
Orange	1.90
Lemon	1.40

Table 1

(i) Transform Table 1 into a diagram showing the mapping from the fruits to their prices. [2 marks]

(ii) Write the domain and range of (a)(i). [2 marks]

(iii) Determine if the relation in (a)(i) is a function. Explain your answer. [2 marks]

(b) For the function $f(x)=\frac{2}{x+3}$ and $g(x)=x-\frac{9}{x}$, find

(i) $(fg)(x)$ and its domain, [5 marks]

(ii) $g[f(x)]$ and its domain, [7 marks]

(iii) $(g-f)(x)$, [3 marks]

(iv) the inverse function of f. [3 marks]

(c) For the equation $e^{3y-1}=(x+4)^2$, find

(i) y as a function of x, [3 marks]

(ii) the domain of y. [1 mark]

(d) A survey of a community of 7,000 residents shows that the number of residents N who have heard a piece of information after m months is given by the formula $m=53.12-6\ln(7,000-N)$.

(i) How many months will it take for half of the residents to learn about a community program of free blood pressure readings? [2 marks]

(ii) How many residents have heard the program after 2 months? [4 marks]

(e) For the function $y(x)=\frac{x-1}{x^2-4}$,

(i) find its x- and y-intercepts, if there are any, [3 marks]

(ii) find the vertical, horizontal, and oblique asymptotes, if there are any, [3 marks]

(iii) use the zeroes of the numerator and denominator of $y(x)$ to divide the x-axis into intervals and determine the interval where $y(x)$ is above or below the x-axis, [4 marks]

(iv) sketch the function $y(x)$. [1 mark]

Continued...

Question 3 (15 marks)

(a) Find the remainder of $f(x) = 3x^{99} - 4x^{75} + 5x^{21}$ when it is divided by $x+1$. [1 mark]

(b) A function is given by $f(x) = x^3 - x^2 - 8x + 12$.

(i) Using rational zeros theorem, list all the possible rational zeros of $f(x)$. [2 marks]

(ii) Verify that $x = 2$ is a zero of $f(x)$. [2 marks]

(iii) Using synthetic division, divide $f(x)$ by the factor that corresponds to $x = 2$ as a zero. Transform your division result into the equation that relates the dividend, divisor, and quotient. [2 marks]

(iv) Using the result of (b)(iii), factorise $f(x)$. [2 marks]

(v) Find the partial fraction decomposition of $\frac{2x^2 - x + 1}{f(x)}$. [6 marks]

Question 4 (15 marks)

(a) (i) Expand $(2x - 3y^2)^4$ using the Binomial Theorem. [4 marks]

(ii) Find the complete term that contains y^{15} in the expansion of $(x^2 - y^3)^9$. [4 marks]

(b) Find the sum of the first 12 terms of the arithmetic sequence $\{2n - 3\}$. [2 marks]

(c) A drug is administered to a patient every day for 5 days. Every time the drug is administered, the drug concentration in the bloodstream raises by 0.4 mg/mL (0.4 mg of drug in 1 mL of blood). Before the injection next day, only 25% of the drug present on the preceding day remains in the bloodstream. The concentration of the drug in the bloodstream (in mg/mL) after the injection on the nth day is C_n.

(i) What is C_1? [1 mark]

(ii) Give the recursive formula for C_n. [1 mark]

(iii) Find the concentration of the drug in the bloodstream after the third injection. [3 marks]

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